

Application/Control Number: 10/673,513

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/673,513

Filing Date: September 30, 2003

Appellant(s): O'MEARA ET AL.

Steven P. Weihrouch
For Appellant

EXAMINER'S ANSWER

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This is in response to the appeal brief filed September 5, 2006 appealing from the Office action mailed February 14, 2006.

The following action is a supplemental answer and is to be considered a substitute for the Examiner's Answer of April 19, 2007. The Answer of April 19, 2007 is hereby vacated as per the Remand from the Board of Patent Appeals and Interferences order of April 1, 2009.

Additionally, it is noted that the applicant has already replied to the arguments in this supplemental answer in the reply brief filed June 7, 2007 which has been noted by the examiner on September 18, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

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(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

20040069225	Fairbairn et al.	04-2004
6762849	Rulkens	07-2004

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

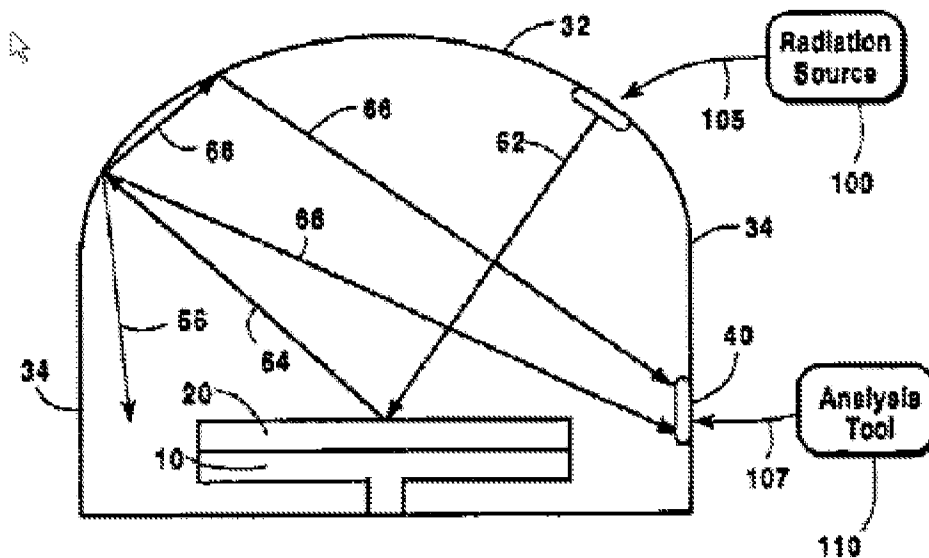
1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-18 and 20-22, 24-27 and 30-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rulkens U.S. Patent 6,762,849 B1 in view of Fairbairn et al., U.S. Patent Application Publication No.: US 2004/0069225 A1.

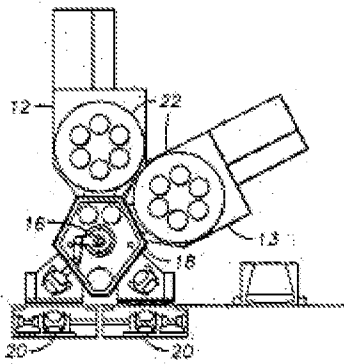
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3. Rulkens discloses a semiconductor process substantially as claimed. See **FIGS. 1-7**, where Rulkens teaches the following limitations.



this figure is

attributed to Rulkens.



this figure is attributed to Fairbairn.

4. Pertaining to claim 1, Rulkens teaches a method of monitoring status of a system component in a process chamber of a processing system, comprising:
- exposing a system component of the batch type processing system to light from a light source **105** (please note that radiation is a form of light, Rulkens discloses various radiation sources in column 5, line 6);

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and monitoring interaction of the light with the system component **107** to determine a stains of the system component. However, Rulkens fails to teach a batch type processing system, (however he does disclose that typical processing tools may include a plurality of chambers is well known, see column 1, lines 40-45). Fairbairn teaches a batch type processing system. In view of Fairbairn it would have been obvious to one of ordinary skill in the art to incorporate a batch type processing system into the Rulkens semiconductor process because a cluster too configured for batch processing allows multiple wafers to be simultaneously processed in a single chamber [0005].

5. Pertaining to claim 2, Rulkens in view of Fairbairn teaches the method according to claim 1, wherein the exposing comprises:

exposing a system component that is transparent to the light (see Rulkens, column 8, lines 56-64).

6. Pertaining to claim 3, Rulkens in view of Fairbairn teaches the method according to claim 1, wherein the exposing comprises: exposing at least one of a process tube, a shield, a ring, a baffle, and a liner to the light (please note that Rulkens discloses consumable or replaceable components such as alumina, column 1, lines 45-47).

7. Pertaining to claim 4, Rulkens in view of Fairbairn teaches the method according to claim 1, wherein the exposing comprises:

exposing a system component including a ceramic material to the light (see column 5, lines 7-

10, where Rulkens teaches depositing various films such as silicon oxide which is a ceramic and

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silicon nitride which is a ceramic). Because the deposition process is exposed in-situ to a radiation source, this limitation is met.

8. Pertaining to claim 5, Rulkens in view of Fairbairn teaches the method according to claim 1, wherein the exposing comprises:

exposing a system component including at least one of an oxide, a nitride, and a carbide to the light (please note that quartz and alumina are composed of oxides). Also please see the rejection of claim 4 above.

9. Pertaining to claim 6, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the exposing comprises: exposing a system component including at least one of quartz, Al_2O_3 , SiN, and SiC to the light. (because Rulkens teaches that the optical view port can comprise alumina, it is well known that the chemical equation for alumina is Al_2O_3 , see column 4, lines 58-60 where alumina is disclosed)

10. Pertaining to claim 7, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the exposing comprises:
exposing a system component having a material deposit to the light (see column 5, lines 3-7 where Rulkens discloses various radiation sources, including visible light).

11. Pertaining to claim 8, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the exposing comprises: exposing a system component having a material deposit to

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the light, the material deposit containing at least one of Si, SiGe, SiN, SiO₂, doped Si, HfO₂, HfSiO, ZrO₂, and ZrSiO_x (please see the rejection of claim 4 above for explanation of the present rejection).

12. Pertaining to claim 9, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the exposing comprises:

using a laser, a LED, a lamp, or a heater for the light source (Please see the rejection of claim 6 above as it applies to the present claim 9).

13. Pertaining to claim 10, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the exposing comprises:

exposing a system component to light from a light source positioned outside a chamber processing zone (see alternative process, column 5, lines 3-5).

14. Pertaining to claim 11, Rulkens in view of Fairbairn teach The method according to claim 1, wherein the exposing comprises:

exposing a system component to light from a light source positioned inside a chamber processing zone (see the rejection of claim 9 above for an explanation).

15. Pertaining to claim 12, Rulkens in view of Fairbairn teach the method according to claim I, wherein the exposing comprises: exposing a system component to light having a single

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wavelength or to light having multiple wavelengths (it is well known that visible light as explained in claim 5 contains multiple wavelengths, also see Rulkens column 5, lines 12-14)).

16. Pertaining to claim 13, Rulkens in view of Fairbairn teach the method according to claim 1, further comprising:

performing a process in the process chamber **32** (Please see FIG. 5).

17. Pertaining to claim 14, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

performing at least one of thermal process and a plasma process (the thermal process is performed with high intensity discharge lamps as disclosed in column 10, lines 25-35).

18. Pertaining to claim 15, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

performing at least one of a chamber cleaning process, a chamber conditioning process, a substrate etching process, and a substrate film formation process (Rulkens teaches that the chamber can also be a plasma etching or plasma cleaning tool, see column 7, lines 45-47).

19. Pertaining to claim 16, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

flowing a process gas including a halogen-containing gas during a chamber cleaning process (please note that the gases fluorine, chlorine and bromine are halogens, see column 5, lines 1-2).

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20. Pertaining to claim 17, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of C1F_3 , F_2 , NF_3 , and HF during a chamber cleaning process (see the rejection of claim 16 above where Rulkens discloses fluorine).

21. Pertaining to claim 18, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

flowing a process gas including at least one of a silicon-containing gas and a nitrogen-containing gas during a chamber conditioning process (because Rulkens discloses forming a silicon oxide, it is well known that a silicon gas and an nitrogen gas will flow into a CVD chamber to form the silicon nitride as disclosed in column 5, line 10).

22. Pertaining to claim 20, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:

flowing a process gas including a halogen-containing gas during a substrate etching process (please see the rejection of claim 16 above).

23. Pertaining to claim 21, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises: flowing a process gas including HF during a substrate etching process (see Fairbairn [0135]). In view of Fairbairn, it would have been obvious to one

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of ordinary skill in the art to incorporate HF into the Rulkens chamber because it is well known that HF etches or cleans semiconductor process material)

24. Pertaining to claim 22, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises: flowing a process gas including at least one of a silicon-containing gas and an nitrogen-containing gas during a substrate film formation process (please see the rejection of claim 18 above).

25. Pertaining to claim 24, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises:
flowing a process gas including a metal-containing gas during a substrate film formation process (i.e., tungsten).

26. Pertaining to claim 25, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing further comprises:
flowing an inert gas including at least one of Ar, He, Ne , Kr, Xe, and N₂ (see column 5, line 1 of Rulkens).

27. Pertaining to claim 26, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises: exposing a system component to a temperature between about 100°C and about 1000°C (the Examiner takes the position that it is well known to form dielectrics in the claimed temperature range).

28. Pertaining to claim 27, Rulkens in view of Fairbairn teach the method according to claim 13, wherein the performing comprises: exposing a system component to a pressure between about 10 mTorr and about 760 Torr (because Rulkens discloses forming a plasma it is well known that plasmas are formed below 760 Torr).

29. Pertaining to claim 30, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the monitoring comprises:
using an optical monitoring system to detect intensity of light transmission from the system component (see the rejection of claim 1 above).

30. Pertaining to claim 31, Rulkens in view of Fairbairn teach the method according to claim 30, wherein the monitoring further comprises: determining if an intensity level of the light transmission from the system component has reached a threshold value (see the rejection of claim 1 above).

31. Pertaining to claim 32, Rulkens in view of Fairbairn teach the method according to claim 31, wherein the monitoring further comprises:
measuring the intensity level of the light transmission component to arrive at a determination of whether to stop the process (see column 13, lines 65-68).

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32. Pertaining to claim 33, Rulkens in view of Fairbairn teach the method according to claim 1, wherein the monitoring comprises:

using an optical monitoring system to detect intensity of light reflection from the system component (see the rejection of claim 32 above).

33. Pertaining to claim 34, Rulkens in view of Fairbairn teach the method according to claim 33, wherein the monitoring further comprises: determining if an intensity level of the light reflection has reached a threshold value (see the rejection of claim 1 above).

34. Pertaining to claim 35, Rulkens in view of Fairbairn teach the method according to claim 34, wherein the monitoring further comprises: measuring the intensity level of the light reflection to arrive at a determination of whether to stop the process (see column 13, lines 65-68).

35. Pertaining to claim 36, Rulkens in view of Fairbairn teach the method according to claim 1, further comprising:

forming a protective coating on a system component.

36. Pertaining to claim 37, Rulkens in view of Fairbairn teach the method according to claim 36, wherein the forming a protective coating comprises:

forming at least one of SiN, SiC, SiO₂, Y₂O₃, Sc₂O₃, Sc₂F₃, YF₃, La₂O₃, CeO₂, Lu₂O₃, Dy₂O₃, SiO₂, MgO, Al₂O₃, ZnO, SnO₂, and In₂O₃ (please see column 5, lines 7-11).

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37. Pertaining to claim 38, Rulkens in view of Fairbairn teach the method according to Claim 1, wherein the monitoring comprises:

using an optical monitoring system to detect said interaction of the light; and
purging optical components of said monitoring system with a purge gas (please note that it is well known to purge the process chamber before depositing another film or equalizing the pressure to atmospheric pressure with a purge gas).

38. Claims 19, 23, 28 and 29 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(10) Response to Argument

Appellants contend that Rulkens fails to disclose a system component.

In response to Appellants contention that Rulkens fail to disclose a system component, it is noted that we can only rely on Appellants definition as to what is a system component. Upon further review, Appellants state that system components can be anything having a protective coating (see [0039] which can be a material pre-deposited during manufacturing of the system component. Appellants further contend that the protective coatings include SiN (i.e., silicon nitride, SiC (silicon nitride), SiO₂ (silicon dioxide) as well as various other films that are deposited inside the chamber. Since it is well known that the process chamber is exposed to deposited films prior to any subsequent processing steps, it would be obvious that the protective coatings are merely nothing more than process films formed on the wafer during normal process

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steps that are well known in the semiconductor art. Since the view port is part of the chamber and film grows on the view port, the view port reaches a point in which the chamber and view port should be either cleaned or replaced. Please see bottom of column 8 and lines 1-26 of column 9 of Rulkens as disclosing the deposition of material on the view ports.

Appellants argue that there is no motivation to combine the primary reference of Rulkens with the secondary reference of Fairbairn, because Rulkens discloses only one wafer and Fairbairn discloses a batch processing system.

Please note that Rulkens discloses the it is well known to use a plurality of chambers as disclosed in column 1, lines 40-45 which will be discussed further below.

Appellants contend that the combined teachings fail to disclose monitoring of the wafer itself. In response to Appellants contention that Rulkens does not monitor the wafer, it appears in the title of the patent publication a in-situ film thickness measurement and its use for in-situ control of deposited film thickness. It is well know that since Rulkens disclose a wafer inside a chamber and the intention is to control the thickness of film grown on the wafer and controlling that thickness is important to Rulkens then it would be obvious that a method is disclosed that a wafer is monitored and therefore Appellants argument is moot.

Appellants argue that the secondary reference Fairbairn does not disclose any optical monitoring system, and thus cannot correct the deficiencies of Rulkens.

In response to Appellants contention that combining Rulkens and Fairbairn, please note that Rulkens discloses that typical processing tools may include a plurality of chambers, whereby each chamber runs a number of varying processing steps(column 1, lines 40-44). Rulkens further explains in the same paragraph that monitoring techniques are typical and under the control of a computer. The difference between Rulkens background of the invention and what is actually disclosed by Rulkens is that the monitoring can be done in-situ (i.e., real-time).

Appellants contend that the combined teachings of Rulkens in view of Fairbairn fail to teach or suggest monitoring a system component. Appellants describe system components as the chamber walls and consumables such as quartz, silicon, alumina, carbon, silicon carbide.

In response to Appellants contention that the combined teachings of Rulkens in view of Fairbairn fail to teach a system component, the Examiner would like to point out that there are various system components in the prior art teachings, separately as well as combined. For instance, Rulkens discloses an optical view port comprised of alumina (see column 4, lines 58-61, please note that it is well known that view ports are bolted onto process chambers and therefore replaceable), Rulkens also includes the chamber walls. Please note that Appellants have not indicated that the system components are temporary or permanent, and although the Examiner stated that the wafer was a system component, the argument from Appellants would not remove the optical window as a system component. Because the radiation source can be located outside the processing chamber and the analysis tool is also located outside the processing chamber and

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the radiation source supplies light the analysis tool measures the intensity of the light. As a film is deposited on the wafer, also please note that view port is required to be replaced or cleaned since it is a form of a liner and since deposited film forms along the chamber wall, the view port or view ports are along the chamber walls the intensity of the light changes and the analysis tool records the changes of the intensity as seen in FIGS. 6 and 7.

Appellants contend there is no motivation to combine Rulkens with Fairbairn because Rulkens only discloses a single substrate processing chamber.

In response to Appellants contention that Rulkens only discloses a single processing chamber, Rulkens would suggest that multiple processing chambers can perform a number of varying processing steps (see column 1, lines 40-45).

Appellants contends that Rulkens cannot reasonably be interpreted as “monitoring a state of a material deposit on a system component to determine a status of the system component.”

Appellants further take the position that this is the first time the Examiner takes the position that the analysis tool of Rulkens monitors changes in intensity of light.

In response to Appellants contention that Rulkens cannot reasonably be interpreted as “monitoring a state of a material deposited on a system component to determine a status of the system component.” Appellants are directed to FIG. 6 where the intensity (signal strength of the CCD is decreased over time (in seconds) as the film thickness is increased.

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Appellants contend that there is no discussion whatsoever in Rulkens of a film deposited on the optical view port or any surface other than the processed substrate.

In response to Appellants contention that a film is deposited on the optical view port or any surface other than the processed substrate, please note that Rulkens discloses several types of deposition chambers, i.e., physical vapor deposition (PVD), Chemical Vapor Deposition (CVD) and Plasma Enhanced Chemical Vapor deposition chambers (PECVD). Please note the very nature of a vapor is a gaseous state. Gases are constantly expanding in a low pressure atmosphere and will impinge on any surface it comes in contact with and is not limited to the substrate and will include the substrate walls and the optical view port. Rulkens also discloses how to prevent deposition of the film onto the internal surfaces of the optical port entry (see column 8, lines 65-68). Therefore Appellants argument is moot.

Appellants have failed to consider the Rulkens reference in its entirety.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

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Respectfully submitted,

/W. David Coleman/, Primary Examiner

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/Matthew S. Smith/

Supervisory Patent Examiner, Art Unit 2823

/T.T./

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/Gladys Corcoran/

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